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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/622,113	POHJOLA ET AL.	
	Examiner	Art Unit	
	LI LIU	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _21 December 2007_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1,3-6 and 8-32_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1,3-6 and 8-32_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _03 November 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 1 and 16-19 have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

2. Claim 16 is objected to because of the following informalities: claim 16, line 4, “the kerb location" should be changed to “a kerb location”. Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 3-6, 8, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morales et al (US 5,706,111) in view of Takai et al (US 6,619,865) and Ahn et al (US 2003/0231382).

1). With regard to claim 1, Morales et al discloses an optical data transmission system (e.g., Figures 2 and 3), comprising:

a hub (the switch center CE in Figure 2);

a kerb location (the access node AN in Figure 2);

an optical router (the multiplexer in the AN and the optical access board OAB: column 4, line 27, and column 5 line 22-23, the multiplexer multiplexes the m different wavelengths over one of the optical fibers to the CE); and

a plurality of optical network units (the optical network terminals ONT in Figure 2), wherein the optical network units are configured to transmit a plurality of respective data signals to the kerb location (Figure 2, the ONTs transmit a plurality of respective data signals to the AN, column 4, line 46 to column 5 line 9), wherein the kerb location includes a plurality of optical wavelength converter (Figure 2, converter in OAB) configured to form data modulated transmission light (column 5, line 17-32),

wherein the optical router is configured to route wavelength channels having predefined wavelength ranges assigned to respective optical network units for transmission to the hub (the multiplexer in the AN/OAB, the multiplexer multiplexes the m different wavelengths, $\Sigma\lambda_i$, over one of the optical fibers to the CE: column 4, line 27, and column 5 line 22-23),

wherein the data signals are converted_into the wavelength channels (Figure 2, converter in OAB, column 5, line 17-32), and

wherein the data signals comprise optical signals (the data signals from the ONT are optical signals, e.g., λ_a , or λ_d or λ_e in Figure 2).

But, Morales et al does not expressly state wherein the kerb location includes a plurality of optically pumped sources configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal.

However, Morales et al expressly discloses that “[c]onsequently the conversion to electrical signals takes place only in the network terminating equipment to which the subscriber terminals are connected” (column 3, line 63-65). Therefore, it is obvious that the AN includes a plurality of optically pumped sources configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal.

Also, Takai, in the same field of endeavor, teaches a similar optical transmission system, the access nod or the remote node includes a plurality of optically pumped sources (e.g., 601-N in Figure 1, 13 in Figure 4, and Figure 6, and Figure 12 etc.) configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal (column 8, line 47 to column 9 line 8, Takai discloses: as the optical frequency conversion element, there are known (a) …, (b) a frequency shifter in which optical signal and modulation light for frequency to be shifted are added to non-linear optical material simultaneously, (c) a frequency shifter using a polarizing rotation element, (d) an optical frequency conversion element having an optical filter for converting into an ASK (amplitude shift keying) signal and an optical frequency variable laser for converting into an FSK (frequency shift keying) signal, and (e) an optical frequency conversion element using four-light wave mixture. As the optical frequency selection and conversion element, there are known (a) an optical frequency conversion element using four-light wave mixture and (b) an integrated element having a combination of the optical frequency conversion element and a variable light filter using a laser. Any of them can be applied

<u>to the embodiment</u>, while the optical frequency conversion element using <u>four-light wave mixture</u> is actually employed in the embodiment. The optical frequency conversion element using the four-light wave mixture has the same configuration as that described in FIG. 2 of paper by G. Grosskopf, R, Ludwig, H. G. Weber, "140 Mbit/s DPSK Transmission Using An All-Optical Frequency Converter With A 400 GHz conversion Range", Electronics Letters, Vol. 24, No. 17, pp. 1106-1107).

Another prior art, Ahn et al, also teaches direct wavelength converters (Figures 1-4), and the optically pumped source (e.g., the SOA in Figure 1) including a laser cavity configured to form data modulated transmission light (e.g., λ_2) and the converting is performed without an intermediate conversion to or from an electrical signal, and wherein the data signal (e.g., λ_1) is optical signal.

Takai teaches that since the optical frequencies for communication for communication between the upper node and the remote node and between the remote node and the terminals are assigned independently, the reliability is high and the flexibility is increased. And the transmitting and receiving optical frequency of the terminal is common to the terminals and fixed, and the frequency range is narrow. Even when a plurality of optical frequency are assigned, frequency spacing may be made wide and accordingly inexpensive and reliable terminals can be attained.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the all-optical converter as taught by Takai et al and Ahn et al to the system of Morales et al so that a cost-effective and highly reliable and flexible network can be realized.

2). With regard to claim 3, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further disclose wherein the data signals are used as pump signals to generate the wavelength channels (the data signals are optical signals, e.g., λ_a , or λ_d or λ_e , the converters are pumped by the data signals from the ONT to generate the wavelength channels λ_1, λ_2 , ... λ_m , Figure 2 of Morales; or Takai: Figure 1, data signal as pump signals λ_{10} , wavelength channels λ_{11}... λ_{1N})

3). With regard to claim 4, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further disclose wherein the data signals are within a wavelength range which does not include the wavelength or wavelengths of the wavelength channels (the wavelength of the data signal as pump signals is λ_a , or λ_d or λ_e, and the wavelength channels are λ_1, λ_2 , ... λ_m , Figure 2 of Morales; or in Takai: the wavelength of data signal as pump signals is λ_{10} , and the wavelength channels are λ_{11}... λ_{1N}).

4). With regard to claim 5, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further disclose wherein the wavelength channels are generated by the plurality of optically pumped sources (OAB in Figure 2 of Moeales, or wavelength converter in Figures 1 and 6 etc of Takai et al).

5). With regard to claim 6, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further disclose wherein the optically pumped sources generate light having

different wavelengths in order to define the wavelength channels having predefined distinct wavelength ranges (OAB in Figure 2 of Moeales, column 5, line 17-32; or wavelength converter in Figures 1 and 6 etc of Takai et al, column 3, line 56 to column 4 line 4)

6). With regard to claim 8, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further disclose wherein respective ones of the optical network units are sufficiently similar that they are interchangeable (column 3, line 13-18, and column 4 line 59-67, the ONTs are identical to each other).

7). With regard to claim 13, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further disclose wherein a pumping light is at a wavelength different from the wavelength of light which is used to carry data traffic in upstream and downstream directions (the wavelength of the data signal as pump signals is λ_a , or λ_d or λ_e, and the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 , … λ_m , Figure 2 of Morales; or in Takai: the wavelength of data signal as pump signals is λ_{10} , and the wavelength used to carry data traffic in upstream and downstream directions are $\lambda_{11}\ldots\lambda_{1N}$).

8). With regard to claim 14, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. And Morales et al and Takai et al and Ahn et al further discloses wherein the optical router is a wavelength division multiplexer (the multiplexer in the AN/OAB, the multiplexer multiplexes the m different

wavelengths, $\Sigma\lambda_i$, over one of the optical fibers to the CE: column 4, line 27, and column 5 line 22-23).

5. Claims 16-19, 21-25 and 27-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morales et al (US 5,706,111) in view of Takai et al (US 6,619,865) and Ahn et al (US 2003/0231382) and Kim et al (Kim et al: “A Low-Cost WDM Source with ASE Injected Fabry-Perot Semiconductor Laser”, IEEE Photonics Technology Letters, Vol. 12, No. 8, August 2000, page 1067-1069).

1). With regard to claim 16, Morales et al discloses a method of transmitting data (e.g., Figures 2 and 3), the method comprising:

transmitting, with an optical network unit (the optical network terminals ONT in Figure 2), a plurality of respective data signals to a kerb location (the access node AN in Figure 2) in an optical data transmission system (Figure 2, the ONTs transmit a plurality of respective data signals to the AN, column 4, line 46 to column 5 line 9),

wherein the kerb location comprises a plurality of optical wavelength converter (Figure 2, converter in OAB) configured to form data modulated transmission light (column 5, line 17-32);

converting the data signals into wavelength channels with a converter (Figure 2, converter in OAB, column 5, line 17-32), and wherein the data signals are optical signals (the data signals from the ONT are optical signals, e.g., λ_a , or λ_d or λ_e in Figure 2); and

routing the wavelength channels having predefined wavelength ranges (e.g., the wavelengths λ_1, λ_2 , … λ_m , in Figure 2) assigned to respective optical network units for

transmission to a hub with an optical router (the multiplexer in the AN/OAB, the multiplexer multiplexes the m different wavelengths, $\Sigma\lambda_i$, over one of the optical fibers to the CE: column 4, line 27, and column 5 line 22-23).

But, Morales et al does not expressly state wherein the plurality of wavelength converters are a plurality of optically pumped sources including a plurality of laser cavities configured to select a resonance peak of an incident light; and wherein the converting is performed without an intermediate conversion to or from an electrical signal.

However, Morales et al expressly discloses that "[c]onsequently the conversion to electrical signals takes place only in the network terminating equipment to which the subscriber terminals are connected" (column 3, line 63-65). Therefore, it is obvious that the AN includes a plurality of optically pumped sources configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal.

Also, Takai, in the same field of endeavor, teaches a similar optical transmission system, the access nod or the remote node includes a plurality of optically pumped sources (e.g., 601-N in Figure 1, 13 in Figure 4, and Figure 6, and Figure 12 etc.) configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal (column 8, line 47 to column 9 line 8, Takai discloses: as the optical frequency conversion element, there are known (a) …, (b) a frequency shifter in which optical signal and modulation light for frequency to be shifted are added to non-linear optical material simultaneously,

(c) a frequency shifter using a polarizing rotation element, (d) an optical frequency conversion element having an optical filter for converting into an ASK (amplitude shift keying) signal and an optical frequency variable laser for converting into an FSK (frequency shift keying) signal, and (e) an optical frequency conversion element using four-light wave mixture. As the optical frequency selection and conversion element, there are known (a) an optical frequency conversion element using four-light wave mixture and (b) an integrated element having a combination of the optical frequency conversion element and a variable light filter using a laser. Any of them can be applied to the embodiment, while the optical frequency conversion element using four-light wave mixture is actually employed in the embodiment. The optical frequency conversion element using the four-light wave mixture has the same configuration as that described in FIG. 2 of paper by G. Grosskopf, R, Ludwig, H. G. Weber, "140 Mbit/s DPSK Transmission Using An All-Optical Frequency Converter With A 400 GHz conversion Range", Electronics Letters, Vol. 24, No. 17, pp. 1106-1107).

Another prior art, Ahn et al, also teaches direct wavelength converters (Figures 1-4), and the optically pumped source (e.g., the SOA in Figure 1) including a laser cavity configured to select a resonance peak (e.g., λ_2) of an incident light (the incident light is the CW λ_2) and the converting is performed without an intermediate conversion to or from an electrical signal, and wherein the data signal (e.g., λ_1) is optical signal.

Still another prior art, Kim, in the same field of endeavor, teaches a plurality of injection locked sources (the F-P SLD in Figures 1 and 5) including a plurality of laser cavities (Fabry-Perot Laser cavity in Figures 1 and 5) configured to select a resonance

peak of an incident light (the injection light from the broad-band source and AWG determine the appropriate resonance peak of the F-P laser, Figure 2).

Takai teaches that since the optical frequencies for communication for communication between the upper node and the remote node and between the remote node and the terminals are assigned independently, the reliability is high and the flexibility is increased. And the transmitting and receiving optical frequency of the terminal is common to the terminals and fixed, and the frequency range is narrow. Even when a plurality of optical frequency are assigned, frequency spacing may be made wide and accordingly inexpensive and reliable terminals can be attained.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the all-optical converter as taught by Takai et al and Ahn et al and Kim to the system and method of Morales et al so that a cost-effective and highly reliable and flexible network can be realized.

2). With regard to claim 17, Morales et al discloses an optical router (the multiplexer in the AN and the optical access board OAB: column 4, line 27, and column 5 line 22-23, the multiplexer multiplexes the m different wavelengths over one of the optical fibers to the CE) for an optical data transmission system (e.g., Figures 2 and 3), the optical data transmission system comprising

a hub (the switch center CE in Figure 2),

a kerb location (the access node AN in Figure 2), and

a plurality of optical network units (the optical network terminals ONT in Figure 2), the optical network units being configured to transmit a plurality of respective data

signals to the kerb location (Figure 2, the ONTs transmit a plurality of respective data signals to the AN, column 4, line 46 to column 5 line 9),

the kerb location comprising a plurality of optical wavelength converter (Figure 2, converter in OAB) configured to form data modulated transmission light (column 5, line 17-32),

the optical router being configured to route wavelength channels having predefined wavelength ranges assigned to respective optical network units for transmission to the hub (the multiplexer in the AN/OAB, the multiplexer multiplexes the m different wavelengths, $\Sigma\lambda_i$, over one of the optical fibers to the CE: column 4, line 27, and column 5 line 22-23), and

the optical router comprising a converter (Figure 2, converter in OAB, column 5, line 17-32) to convert the data signals into the wavelength channels, and

wherein the data signals are optical signals (the data signals from the ONT are optical signals, e.g., λ_a , or λ_d or λ_e in Figure 2).

But, Morales et al does not expressly state wherein the plurality of wavelength converters are a plurality of optically pumped sources including a plurality of laser cavities configured to select a resonance peak of an incident light, and wherein the conversion is performed without any intermediate conversion to or from an electrical signal.

However, Morales et al expressly discloses that "[c]onsequently the conversion to electrical signals takes place <u>only</u> in the network terminating equipment to which the subscriber terminals are connected" (column 3, line 63-65). Therefore, it is obvious that

the AN includes a plurality of optically pumped sources configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal.

Also, Takai, in the same field of endeavor, teaches a similar optical transmission system, the access nod or the remote node includes a plurality of optically pumped sources (e.g., 601-N in Figure 1, 13 in Figure 4, and Figure 6, and Figure 12 etc.) configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal (column 8, line 47 to column 9 line 8, Takai discloses: as the optical frequency conversion element, there are known (a) …, (b) a frequency shifter in which optical signal and modulation light for frequency to be shifted are added to non-linear optical material simultaneously, (c) a frequency shifter using a polarizing rotation element, (d) an optical frequency conversion element having an optical filter for converting into an ASK (amplitude shift keying) signal and an optical frequency variable laser for converting into an FSK (frequency shift keying) signal, and (e) an optical frequency conversion element using four-light wave mixture. As the optical frequency selection and conversion element, there are known (a) an optical frequency conversion element using four-light wave mixture and (b) an integrated element having a combination of the optical frequency conversion element and a variable light filter using a laser. <u>Any of them can be applied to the embodiment</u>, while the optical frequency conversion element using <u>four-light wave mixture</u> is actually employed in the embodiment. The optical frequency conversion element using the four-light wave mixture has the same configuration as that described

in FIG. 2 of paper by G. Grosskopf, R, Ludwig, H. G. Weber, "140 Mbit/s DPSK Transmission Using An All-Optical Frequency Converter With A 400 GHz conversion Range", Electronics Letters, Vol. 24, No. 17, pp. 1106-1107).

Another prior art, Ahn et al, also teaches direct wavelength converters (Figures 1-4), and the optically pumped source (e.g., the SOA in Figure 1) including a laser cavity configured to select a resonance peak (e.g., λ_2) of an incident light (the incident light is the CW λ_2) and the converting is performed without an intermediate conversion to or from an electrical signal, and wherein the data signal (e.g., λ_1) is optical signal.

Still another prior art, Kim, in the same field of endeavor, teaches a plurality of injection locked sources (the F-P SLD in Figures 1 and 5) including a plurality of laser cavities (Fabry-Perot Laser cavity in Figures 1 and 5) configured to select a resonance peak of an incident light (the injection light from the broad-band source and AWG determine the appropriate resonance peak of the F-P laser, Figure 2).

Takai teaches that since the optical frequencies for communication for communication between the upper node and the remote node and between the remote node and the terminals are assigned independently, the reliability is high and the flexibility is increased. And the transmitting and receiving optical frequency of the terminal is common to the terminals and fixed, and the frequency range is narrow. Even when a plurality of optical frequency are assigned, frequency spacing may be made wide and accordingly inexpensive and reliable terminals can be attained.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the all-optical converter as taught by Takai et al

and Ahn et al and Kim to the system of Morales et al so that a cost-effective and highly reliable and flexible network can be realized.

3). With regard to claim 18, Morales et al discloses a converter (Figure 2, converter in OAB) for an optical data transmission system (e.g., Figures 2 and 3), the optical data transmission system comprising

a hub (the switch center CE in Figure 2),

a kerb location (the access node AN in Figure 2),

an optical router (the multiplexer in the AN and the optical access board OAB: column 4, line 27, and column 5 line 22-23, the multiplexer multiplexes the m different wavelengths over one of the optical fibers to the CE), and

a plurality of optical network units (the optical network terminals ONT in Figure 2), the optical network units being configured to transmit a plurality of respective data signals to the kerb location (Figure 2, the ONTs transmit a plurality of respective data signals to the AN, column 4, line 46 to column 5 line 9),

wherein the kerb location comprises a plurality of optical wavelength converter (Figure 2, converter in OAB) configured to form data modulated transmission light (column 5, line 17-32),

the converter being configured to convert the data signals (e.g., λ_a , or λ_d or λ_e in Figure 2) into wavelength channels having predefined wavelength ranges (e.g., the wavelengths λ_1, λ_2 , … λ_m , in Figure 2) assigned to respective optical network units, and

the optical router being configured to route the wavelength channels for transmission to the hub (the multiplexer in the AN/OAB, the multiplexer multiplexes the m different wavelengths, $\Sigma\lambda_i$, over one of the optical fibers to the CE: column 4, line 27, and column 5 line 22-23), wherein the data signals are optical signals (the data signals from the ONT are optical signals, e.g., λ_a , or λ_d or λ_e in Figure 2).

But, Morales et al does not expressly state wherein the plurality of wavelength converters are a plurality of optically pumped sources including a plurality of laser cavities configured to select a resonance peak of an incident light, and the conversion is performed without any intermediate conversion to or from an electrical signal.

However, Morales et al expressly discloses that "[c]onsequently the conversion to electrical signals takes place <u>only</u> in the network terminating equipment to which the subscriber terminals are connected" (column 3, line 63-65). Therefore, it is obvious that the AN includes a plurality of optically pumped sources configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal.

Also, Takai, in the same field of endeavor, teaches a similar optical transmission system, the access nod or the remote node includes a plurality of optically pumped sources (e.g., 601-N in Figure 1, 13 in Figure 4, and Figure 6, and Figure 12 etc.) configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal (column 8, line 47 to column 9 line 8, Takai discloses: as the optical frequency conversion element, there are known (a) …, (b) a frequency shifter in which optical signal and modulation

light for frequency to be shifted are added to non-linear optical material simultaneously, (c) a frequency shifter using a polarizing rotation element, (d) an optical frequency conversion element having an optical filter for converting into an ASK (amplitude shift keying) signal and an optical frequency variable laser for converting into an FSK (frequency shift keying) signal, and (e) an optical frequency conversion element using four-light wave mixture. As the optical frequency selection and conversion element, there are known (a) an optical frequency conversion element using four-light wave mixture and (b) an integrated element having a combination of the optical frequency conversion element and a variable light filter using a laser. <u>Any of them can be applied to the embodiment</u>, while the optical frequency conversion element using <u>four-light wave mixture</u> is actually employed in the embodiment. The optical frequency conversion element using the four-light wave mixture has the same configuration as that described in FIG. 2 of paper by G. Grosskopf, R, Ludwig, H. G. Weber, "140 Mbit/s DPSK Transmission Using An All-Optical Frequency Converter With A 400 GHz conversion Range", Electronics Letters, Vol. 24, No. 17, pp. 1106-1107).

Another prior art, Ahn et al, also teaches direct wavelength converters (Figures 1-4), and the optically pumped source (e.g., the SOA in Figure 1) including a laser cavity configured to select a resonance peak (e.g., λ_2) of an incident light (the incident light is the CW λ_2) and the converting is performed without an intermediate conversion to or from an electrical signal, and wherein the data signal (e.g., λ_1) is optical signal.

Still another prior art, Kim, in the same field of endeavor, teaches a plurality of injection locked sources (the F-P SLD in Figures 1 and 5) including a plurality of laser

cavities (Fabry-Perot Laser cavity in Figures 1 and 5) configured to select a resonance peak of an incident light (the injection light from the broad-band source and AWG determine the appropriate resonance peak of the F-P laser, Figure 2).

Takai teaches that since the optical frequencies for communication for communication between the upper node and the remote node and between the remote node and the terminals are assigned independently, the reliability is high and the flexibility is increased. And the transmitting and receiving optical frequency of the terminal is common to the terminals and fixed, and the frequency range is narrow. Even when a plurality of optical frequency are assigned, frequency spacing may be made wide and accordingly inexpensive and reliable terminals can be attained.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the all-optical converter as taught by Takai et al and Ahn et al and Kim to the system of Morales et al so that a cost-effective and highly reliable and flexible network can be realized.

4). With regard to claim 19, Morales et al discloses an optical data transmission system (e.g., Figures 2 and 3), comprising:

transmitting means (the transmitter in the optical network terminals ONT in Figure 2) for transmitting, with an optical network unit (the optical network terminals ONT in Figure 2), a plurality of respective optical signals to a kerb location (Figure 2, the ONTs transmit a plurality of respective data signals to the AN, column 4, line 46 to column 5 line 9),

wherein the kerb location comprises a plurality of optical wavelength converter (Figure 2, converter in OAB) configured to form data modulated transmission light (column 5, line 17-32);

converting means (Figure 2, converter in OAB) for converting the optical signals into wavelength channels with a converter (Figure 2, column 5, line 17-32); and

routing means (the multiplexer in the AN and the optical access board OAB: column 4, line 27, and column 5 line 22-23) for routing the wavelength channels having predefined wavelength ranges assigned to respective optical network units for transmission to a hub with an optical router (Figure 2, the multiplexer in OAB multiplexes the m different wavelengths, $\Sigma\lambda_i$, over one of the optical fibers to the CE).

But, Morales et al does not expressly state wherein the plurality of wavelength converters are a plurality of optically pumped sources including a plurality of laser cavities configured to select a resonance peak of an incident light, and wherein the converting is performed without any intermediate conversion to or from an electrical signal.

However, Morales et al expressly discloses that "[c]onsequently the conversion to electrical signals takes place only in the network terminating equipment to which the subscriber terminals are connected" (column 3, line 63-65). Therefore, it is obvious that the AN includes a plurality of optically pumped sources configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal.

Also, Takai, in the same field of endeavor, teaches a similar optical transmission system, the access nod or the remote node includes a plurality of optically pumped sources (e.g., 601-N in Figure 1, 13 in Figure 4, and Figure 6, and Figure 12 etc.) configured to form data modulated transmission light, and the conversion being performed without any intermediate conversion to or from an electrical signal (column 8, line 47 to column 9 line 8, Takai discloses: as the optical frequency conversion element, there are known (a) …, (b) a frequency shifter in which optical signal and modulation light for frequency to be shifted are added to non-linear optical material simultaneously, (c) a frequency shifter using a polarizing rotation element, (d) an optical frequency conversion element having an optical filter for converting into an ASK (amplitude shift keying) signal and an optical frequency variable laser for converting into an FSK (frequency shift keying) signal, and (e) an optical frequency conversion element using four-light wave mixture. As the optical frequency selection and conversion element, there are known (a) an optical frequency conversion element using four-light wave mixture and (b) an integrated element having a combination of the optical frequency conversion element and a variable light filter using a laser. Any of them can be applied to the embodiment, while the optical frequency conversion element using four-light wave mixture is actually employed in the embodiment. The optical frequency conversion element using the four-light wave mixture has the same configuration as that described in FIG. 2 of paper by G. Grosskopf, R, Ludwig, H. G. Weber, "140 Mbit/s DPSK Transmission Using An All-Optical Frequency Converter With A 400 GHz conversion Range", Electronics Letters, Vol. 24, No. 17, pp. 1106-1107).

Another prior art, Ahn et al, also teaches direct wavelength converters (Figures 1-4), and the optically pumped source (e.g., the SOA in Figure 1) including a laser cavity configured to select a resonance peak (e.g., λ_2) of an incident light (the incident light is the CW λ_2) and the converting is performed without an intermediate conversion to or from an electrical signal, and wherein the data signal (e.g., λ_1) is optical signal.

Still another prior art, Kim, in the same field of endeavor, teaches a plurality of injection locked sources (the F-P SLD in Figures 1 and 5) including a plurality of laser cavities (Fabry-Perot Laser cavity in Figures 1 and 5) configured to select a resonance peak of an incident light (the injection light from the broad-band source and AWG determine the appropriate resonance peak of the F-P laser, Figure 2).

Takai teaches that since the optical frequencies for communication for communication between the upper node and the remote node and between the remote node and the terminals are assigned independently, the reliability is high and the flexibility is increased. And the transmitting and receiving optical frequency of the terminal is common to the terminals and fixed, and the frequency range is narrow. Even when a plurality of optical frequency are assigned, frequency spacing may be made wide and accordingly inexpensive and reliable terminals can be attained.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the all-optical converter as taught by Takai et al and Ahn et al and Kim to the system of Morales et al so that a cost-effective and highly reliable and flexible network can be realized.

5). With regard to claim 21, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 16 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose the method of transmitting data further comprising optically pumping, at the kerb location, the plurality of optically pumped sources with the plurality of respective data signals (the data signals as pump signal are optical signals with wavelength λ_a , or λ_d or λ_e, Figure 2 of Morales; or in Takai: the data signals as pump signals are optical signals with wavelength λ_{10}).

6). With regard to claim 22, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 16 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein each wavelength channel has a predefined distinct wavelength range (e.g., the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 , ... λ_m, Figure 2 of Morales; or in Takai: the wavelength used to carry data traffic in upstream and downstream directions are λ_{11}... λ_{1N}).

7). With regard to claim 23, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 16 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein the data signals are within a wavelength range which does not include the wavelength or wavelengths of the wavelength channels (the wavelength of the data signal as pump signals is λ_a , or λ_d or λ_e, and the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 , ... λ_m , Figure 2 of Morales; or in Takai: the wavelength of data signal as

pump signals is λ_{10} , and the wavelength used to carry data traffic in upstream and downstream directions are $\lambda_{11} \ldots \lambda_{1N}$).

8). With regard to claim 24, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 17 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein the wavelength channels are generated by the plurality of optically pumped sources (the data signals are optical signals, e.g., λ_a , or λ_d or λ_e , the converters are pumped by the data signals from the ONT to generate the wavelength channels λ_1, λ_2 , … λ_m , Figure 2 of Morales; or Takai: Figure 1, data signal as pump signals λ_{10} , wavelength channels $\lambda_{11} \ldots \lambda_{1N}$), the optically pumped sources being injection lock lasers (Takai: column 8, line 47 to column 9 line 8; or Figure 1 of Ahn et al; or Kim: the injection locked laser F-P SLD).

9). With regard to claim 25, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 17 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein an injection wavelength is selected by a wavelength division multiplexer and/or an arrayed waveguide grating (e.g., the AWG in Figure 1 and 5 of Kim et al).

10). With regard to claim 27, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 18 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein wavelengths of the plurality of data signals do not include the wavelength or wavelengths of the wavelength channels (the wavelength of the data signal as pump signals is λ_a , or λ_d or λ_e, and the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 ,

… λ_m , Figure 2 of Morales; or in Takai: the wavelength of data signal as pump signals is λ_{10} , and the wavelength used to carry data traffic in upstream and downstream directions are λ_{11}… λ_{1N}).

11). With regard to claim 28, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 18 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein the wavelength channels are generated by the plurality of optically pumped sources (Morales et al, Figure 2, converter in OAB, column 5, line 17-32).

12). With regard to claim 29, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claims 18 and 28 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein the optically pumped sources generate light having different wavelengths in order to define the wavelength channels having predefined distinct wavelength ranges (e.g., the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 , … λ_m, Figure 2 of Morales; or in Takai: the wavelength used to carry data traffic in upstream and downstream directions are λ_{11}… λ_{1N}).

13). With regard to claim 30, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 19 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose the optical data transmission system further comprising pumping means for optically pumping the plurality of optically pumped sources at the kerb location (e.g., the optical wavelength converter in OAB

Figure 2 of Morales et al; or Takai: the 601-N in Figure 1, 13 in Figure 4, and Figure 6, and Figure 12 etc.).

14). With regard to claim 31, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 19 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein each wavelength channel has a predefined distinct wavelength range (e.g., the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 , … λ_m, Figure 2 of Morales; or in Takai: the wavelength used to carry data traffic in upstream and downstream directions are λ_{11}… λ_{1N}).

15). With regard to claim 32, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claim 19 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein the optical signals are within a wavelength range which does not include the wavelength or wavelengths of the wavelength channels (the wavelength of the data signal as pump signals is λ_a , or λ_d or λ_e, and the wavelength used to carry data traffic in upstream and downstream directions are λ_1, λ_2 , … λ_m , Figure 2 of Morales; or in Takai: the wavelength of data signal as pump signals is λ_{10} , and the wavelength used to carry data traffic in upstream and downstream directions are λ_{11}… λ_{1N}).

6. Claims 9, 10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morales et al (US 5,706,111) and Takai et al (US 6,619,865) and Ahn et al (US 2003/0231382) as applied to claims 1 and 5 above, and in further view of Kim et al (Kim

et al: "A Low-Cost WDM Source with ASE Injected Fabry-Perot Semiconductor Laser", IEEE Photonics Technology Letters, Vol. 12, No. 8, August 2000, page 1067-1069).

1). With regard to claim 9, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. Ahn et al discloses an optically pumped source that is injection locked laser (Figure 1, the SOA is injection locked by the CW $\lambda 2$).

Another prior art, Kim, in the same field of endeavor, teaches a plurality of injection locked sources (the F-P SLD in Figures 1 and 5) that are injection locked lasers (the injection light from the broad-band source and AWG determine the appropriate resonance peak of the F-P laser, Figure 2).

Kim et al discloses a cost-effective WDM PON architecture. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the injection locked laser as taught by Ahn et al and Kim to the system of Morales et al and Takai et al so that a cost-effective and highly reliable and flexible network can be realized.

2). With regard to claim 10, Morales et al and Takai et al and Ahn et al and Kim et al disclose all of the subject matter as applied to claims 1, 5, 9 and 10 above. And Morales et al and Takai et al and Ahn et al and Kim et al further disclose wherein an injection wavelength is selected by a wavelength division multiplexer and/or an arrayed waveguide grating (e.g., the AWG in Figure 1 and 5 of Kim et al select the injection wavelength).

3). With regard to claim 15, Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. But Morales aand Takai et al do not expressly disclose wherein the optical router is an arrayed wavelength grating.

However, Kim, in the same field of endeavor, teaches an arrayed wavelength grating as the router or multiplexer (e.g., the AWG in Figure 1 and 5 of Kim et al). The AWG is commonly used as the multiplexer/demultplexer in WDM system. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the AWG in the system of Morales et al and Takai et al so that the WDM signals can be conveniently multiplexed or demultiplexed.

7. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morales et al (US 5,706,111) and Takai et al (US 6,619,865) and Ahn et al (US 2003/0231382) as applied to claim 1 above, and in further view of Kim et al (Kim et al: “A Low-Cost WDM Source with ASE Injected Fabry-Perot Semiconductor Laser”, IEEE Photonics Technology Letters, Vol. 12, No. 8, August 2000, page 1067-1069) and Zah (US 6,434,175).

Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. But Morales and Takai et al do not expressly disclose the optically pumped sources each comprising a laser cavity, mirrors defining the cavity, and wavelength selective elements inside the cavity.

Ahn et al teaches an optically pumped sources each comprising a laser cavity, mirrors defining the cavity (Figures 1-4, [0044]-[0046]).

And, another prior art, Kim, discloses injection locked sources each comprising a laser cavity (Fabry-Perot Laser cavity in Figures 1 and 5), mirrors defining the cavity (by definition or textbook knowledge, the F-P Laser is “a laser oscillator in which two mirrors are separated by an amplifying medium with an inverted population, making a Fabry-Perot cavity”. That is, the reflective mirrors must be present in the F-P laser so that it can be called F-P Laser).

But, Kim et al does not expressly disclose the wavelength selective elements inside the cavity.

However, a laser cavity with the wavelength selective element inside, such as the phasar laser, is well known and widely practice in the art. Zah teaches such a laser, a multiwavelength laser includes a multiplexer (inside the laser cavity) for providing wavelength accuracy and reflectors for forming laser cavity (Figure 1, column 2, line 5-10, and column 3 line 58 to column 4 line 34). Zah teaches a plurality of optical gain sources (e.g., the optical gain medium 118 in Figure 1), the optical gain sources each comprising a laser cavity (laser cavity 142 is formed by the mirror 136 and facet 332 in Figure 1), mirrors defining the cavity (the mirror 136 and facet 332 define the cavity), and wavelength selective elements (the phasar multiplexer 320 inside the cavity).

Kim et al teaches a cost-effective WDM PON system. Zah provides laser with a high wavelength accuracy and selectivity, simplified packaging and compactness, without complications, to support the DWDM applications. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the laser cavity as taught by Zah and Kim to the system of Morales et al and

Takai et al and Ahn et al so that a cost-effective, compact, high wavelength accuracy and selectivity multiwavelength laser system can be obtained.

8. Claims 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morales et al (US 5,706,111) and Takai et al (US 6,619,865) and Ahn et al (US 2003/0231382) as applied to claim 1 above, and in further view of Zah (US 6,434,175).

Morales et al and Takai et al and Ahn et al disclose all of the subject matter as applied to claim 1 above. But Morales and Takai et al do not expressly disclose wherein the optically pumped sources are external cavity lasers.

However, the external cavity laser is well known in the art. Zah teaches such a laser, a multiwavelength laser includes a multiplexer (inside the laser cavity) for providing wavelength accuracy and reflectors for forming laser cavity (Figure 1, column 2, line 5-10, and column 3 line 58 to column 4 line 34). Zah teaches a plurality of optical gain sources (e.g., the optical gain medium 118 in Figure 1), the optical gain sources each comprising a external laser cavity (laser cavity 142 is formed by the mirror 136 and facet 332 in Figure 1), mirrors defining the cavity (the mirror 136 and facet 332 define the external cavity).

Zah provide laser with a high wavelength accuracy and selectivity, simplified packaging and compactness, without complications, to support the DWDM applications. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the external cavity laser as taught by Zah to the system of Morales et al and Takai et al and Ahn et al so that a compact, high wavelength accuracy and selectivity multiwavelength laser system can be obtained.

9. Claims 12 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morales et al and Takai et al and Ahn et al and Kim et al as applied to claims 1, 5, 9 and 10 above, and in further view of Zah (US 6,434,175).

Morales et al and Takai et al and Ahn et al an dKim et al disclose all of the subject matter as applied to claims 1, 5, 9, 10 and 17 above. But Morales and Takai et al do not expressly disclose wherein the optical router is within a laser cavity of at least one optically pumped source.

However, a laser cavity with the wavelength selective element (e.g., the wavelength multiplexer) inside, such as the phasar laser, is well known and widely practice in the art. Zah teaches such a multiwavelength laser system, a multiwavelength laser includes a multiplexer (inside the laser cavity) for providing wavelength accuracy and reflectors for forming laser cavity (Figure 1, column 2, line 5-10, and column 3 line 58 to column 4 line 34). Zah teaches a plurality of optical gain sources (e.g., the optical gain medium 118 in Figure 1), the optical gain sources each comprising a laser cavity (laser cavity 142 is formed by the mirror 136 and facet 332 in Figure 1), mirrors defining the cavity (the mirror 136 and facet 332 define the cavity), and wavelength selective elements (the phasar multiplexer 320 inside the cavity).

Zah provides a laser system with a high wavelength accuracy and selectivity, simplified packaging and compactness, without complications, to support the DWDM applications. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the multiplexer/router within the laser cavity as

taught by Zah to the system of Morales et al and Takai et al and Ahn et al so that a compact, high wavelength accuracy and selectivity WDM system can be obtained.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chiaroni et al (US 5,953,142);

Stubkjaer (Stubkjaer: “Semiconductor Optical Amplifier-Based All-Optical Gates for High-Speed Optical Processing”, IEEE Journal on Selected Topics in Quantum Electronics, Vol. 6, No. 6, November/December 2000, pages 1428-1435.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LI LIU whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Li Liu
March 8, 2008

/Kenneth N Vanderpuye/
Supervisory Patent
Examiner, Art Unit 2613